

colour, and that taste in colour will rarely be correct which is not founded on a knowledge of these immutable laws. It is necessary, therefore, to make them more generally known, not only to designers, but to all classes, who are called upon more or less to judge of its employment.

To give, however, some idea of the public education and the public taste as to colour, I may, perhaps, be allowed to relate two circumstances which I think will aptly illustrate the want of instruction prevalent in the matter of colour. Being lately in the workshops of a manufacturer, who employs several hundred workpeople upon a branch of industry largely dependent on colour for its decoration, and happening to speak of the laws of colour, I was interrupted by the remark,—"Laws of colour: to what do you refer? I was not aware that there were any laws of colour." It was to meet this ignorance that this Department issued their diagram of colour, which, at a small cost, gives, in words intelligible to all, some of the simplest of these laws; and it is hoped that its distribution in our schools, in our workshops, nay, in the nurseries of our children, will prevent in future such an inquiry as whether there are indeed laws of colour. The second incident occurred to me a short time ago, when, being by accident early in the morning as a casual and unknown customer in the rooms of a carpet warehouse, doing perhaps as large an amount of general business as any house in London, whilst making my own purchase I was led to look round, by over-hearing a dialogue between the principal of the house and a manufacturer's agent, who had brought up a number of pieces of carpet as new patterns for the tradesman to choose from. His choice was no doubt regulated by what he could judge would be the taste of his customers. When I looked round I found, to my surprise (although, perhaps, it may not so greatly surprise you), that these several patterns consisted of but two showy designs, with very brilliant colouring applied, with perfect indifference, to the same ornamental forms; so that what was green in one was blue in another and red in a third,—at random.

Now as harmony under these conditions must be impossible, and as only one could be right, whilst all might be wrong, I think it may illustrate the value that a knowledge of the laws of colour would have been, both to the manufacturer and the trader, and how little their choice could be consonant with what was really good taste, from their want of knowledge of these laws. To explain this I have prepared a diagram to show that colours must be arranged together in specific and absolute quantities to be agreeable to the eye: it is founded on the experiments of Field, who laid down, from able researches and experiments, what these relative quantities must be. Thus, in arrangements of the primaries, a surface quantity of three yellow requires, to be agreeable to the eye, a surface of five red and eight blue, or three yellow harmonises with its secondary purple as three to thirteen in surface quantity. If, therefore, in any composition these colours were used interchangeably in the ornamental spaces, it must be inharmonious, unless another law is attended to, which is, that a *hue* of colour diluted with white into a *tint*, requires a much greater increase of surface quantity to contrast harmoniously with its complementary full *hue*. Of these rules the manufacturer, however, did not seem in the slightest degree aware, since the colours were as full in hue in the one case as in the other.

Time will not permit me, even if it were desirable, to give other illustrations of the various ways in which taste is improved and informed; and that correct judgment, which is called *good taste*, acquired by the study of nature's laws, and of those rules which govern artistic and ornamental arrangements. I have said already that the public pays dearly for its want of instruction in those laws—pays, not by hundreds, or by thousands, but by hundreds of thousands; and this might be proved in a multitude of ways. I have just been speaking of colour. Now the least knowledge of its laws will shew that the simplest combinations of colours are the most harmonious.

Yet the paper-stainer, the calico-printer, the silk and ribbon weaver, the carpet-manufacturer, and a host of others that I need not enumerate, are striving to gratify the public by introducing the largest possible number of colours into their patterns, not only, by throwing away useless labour, rendering costly those few to which fashion gives a certain amount of success, but still further increasing their price by those numerous patterns which are failures in the market, being such faulty, overcoloured efforts after novelty—such lawless and abortive productions, that even an uneducated public cannot tolerate them, and they are sold off at the end of the season at a "tremendous sacrifice;" their cost, by the immutable laws of trade, becoming an extra charge, reckoned beforehand, on those which were at least less unsuccessful, which cost, of course, comes out of the pockets of the untaught public. Now, if there is this loss on one kind of manufactures or fabrics, what must be the loss on all, when we consider the fearful over-ornamentation they too largely display?—the carving, inlaying, gilding, and burnishing that are thrown away upon them,—for where there is much ornamentation we may be pretty sure that it is in bad taste or ill applied.

DRAINAGE OF TOWNS.

PIPE DRAINS AND BRICK SEWERS.

At the Institution of Civil Engineers, on the 23rd inst. Mr. Robert Rawlinson read a paper "On the Drainage of Towns." We pass over the introductory matter, and proceed to the practical.

It was to the social effect of town drainage he said that the attention of civil engineers would be most naturally directed, as under that head the leading principles of actual practice and the proposed modifications must be brought forward and discussed.

The position of the outlet would in some measure be governed by natural local conditions, and the dimensions would be fixed by the area and the number of houses to be drained.

The material of construction was a question dependent very much on experience and practice: earthenware pipes were, however, according to the author's views, the most economical and effective for all sewers and drains within the capacity of the material.

It was contended that town sewers could not receive the excessive flood waters, even of the urban portion of the site: they should never receive the suburban drainage, nor be combined with watercourses: they should be adapted solely to remove the solid and liquid refuse from the houses. Mr. Rawlinson considered it was safer for the inhabitants that there should be no sewers at all, rather than they should be of such dimensions as to become places of deposit. Pumping, it was stated, could be profitably adopted in certain situations, where, from the level, or the effect of tidal influence, the outlet flow might be checked. Intercepting sewers at mid-level were approved. Sewers of minimum dimensions were advocated, in connection with pumping; and they should be capable of resisting internal hydraulic pressure in case of the water rising in them.

The flow through sewers should be constant, and it was argued this could only be secured by having conduits adapted to the delivery.

It was contended that the maximum surface water could not be passed through the sewers, but the natural surface outlet should be retained, to assist in carrying off flood waters from the streets of large cities. The fact of town sewers not having been originally intended to receive house drainage or soil was prominently noticed. The want of connection between the houses and the sewers in many parts of the metropolis, the absolute disconnection at Paris, and the prohibitory law, only recently repealed, at Liverpool, were quoted.

With regard to earthenware pipes, 3 inches diameter was considered too small for any drain pipes, and 30 inches diameter too large for the material of which they were at present made.

Pipes of 4 inches diameter would probably be found the least sectional area that should be

used for house drains, and 9 inches for streets. House drains should not be laid at a less gradient than one in sixty. It was decided that the beneficial use of pipe sewers could not be pushed beyond certain limits; but the system should not be condemned, because it had been denounced by those who wanted experience.

The general success of the use of egg-shaped pipe sewers, at Manchester, was given as an example of the advantageous adoption of the pipe system.

Sewers of radiated bricks, moulded for the purpose, might, in some cases, be better and cheaper than large earthen pipes; a sewer thus constructed, 3 feet in diameter, being cheaper than one of pottery pipe of 20 inches diameter; their relative capacities being as the squares of their diameters; and there was no reason why brick sewers should not be as smooth within and as impervious as any pottery pipe.

It was stated that natural outlets had in many cases been destroyed, that houses had been built and cellars dug in improper places, and that large sewers had been constructed, where they were stopped or back-watered during a considerable portion of each twenty-four hours.

After treating of side junctions, gully-holes, drain-traps, and ventilation, the use of cast-iron conduits, in certain bad soils, was advocated, and, as a summary, it was stated that all sewers should be below the level of the cellars, if they were to be of use, and should be specially adapted to the work they had to perform. All sewers and drains should be impervious to water, and should present even and smooth surfaces: the gradient of all large sewers, in steep ground, should be such as would resist rapid wear and bursting; wherever it was practicable, the outlet should be free, and in all cases complete ventilation must be provided for.

In the course of the discussion which followed, the writer mentioned, that at Hitchin the largest pipe drain used was 20 inches; and at that place no breakages had occurred. The length of each pipe was 2 feet 6 inches. If he had acted upon Mr. Roe's table, lately published, the outlet drains should have been 5 feet diameter, whereas they were now pipes of 20 inches. They were socket-pipes throughout. In Bury, in 1847, pipes were laid down in Bark King-street, a place where fever had never previously been absent. It had a letter lately from there, which stated that the pipe drainage had worked entirely to the satisfaction of the town, and most beneficially as regarded the health of the people in the district.

Mr. G. Dornford (being called on) said, that though there had been many successful cases, there had also been several cases of breakage. It had properly been said, that if any works should be permanent they should be those of drainage; but if the materials were subject to breakage, there must be something very unsatisfactory in the system. There had been failures lately, he had heard, through the weakness of the pipes used. It was certainly most desirable that they should attain some form of sewers that did not require to be opened and re-laid down twice in the course of a year. He had heard that at Croydon they had been obliged to case a 15-inch pipe drain with brick in order to preserve it. Would it not have been better to have had the brick sewer constructed at once?

Mr. Rawlinson repudiated the responsibility of works of which he knew nothing from personal observation, for he had never seen those at Croydon. He would, however, never use socket-joints (in deep cuttings) of more than 15 inches diameter. He did not think very large pipe sewers could be joined together, in sockets, without the risk of breaking. Hollow brick sewers might sometimes prove very useful.

Lord Ebrington stated, that he had watched with considerable interest the working of the new system of drainage at St. Thomas's, near Exeter. The effect there had been very satisfactory. He had seen some of the pipes after they had been in use some time (and he had heard from others that such was the case about the district), which were as clear of deposit as the first day they were laid down. 18-inch pipe drains had been there doing the work satisfactorily, which formerly would have been deemed to require much more expensive and much larger brick sewers. No doubt great difficulty would still be experienced in using the large-sized pipes. Indeed, he had often marvelled how such long cylinders could be laid so true as not to